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DYNAMIC ACTUATOR

FINAL TECHNICAL REPORT 20 May - 21 June 1996

by

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1.0 ABSTRACT

The completion of the project has been achieved earlier than scheduled following the rapid progress reported in earlier interim reports. The dynamic actuator is ready for shipment and final packaging and delivery to Mildenhall AFB will be completed following acceptance. The actuator is based on the principles of the stored angular momentum system developed at Cambridge University for use in earthquake centrifuge modelling and is compatible with the Equivalent Shear Beam model container design developed under an earlier research contract. Full documentation of the research equipment will be shipped with the component parts and is not attached to this Final Report. The actuator is designed to benefit from the high payload capacity of the new Acutronic 684-1 civil engineering centrifuge at the Waterways Experiment Station and will provide a shaking capability for deep models in excess of 150 gravities.

2.0 FABRICATION AND ASSEMBLY

The completion of the manufacturing stage of the actuator components has been achieved earlier than scheduled and the actuator is now ready for shipment to the USA. Crating and final packaging for delivery to Mildenhall is awaiting acceptance.

The actuator design is based on a development of the successful stored angular momentum system pioneered at Cambridge University for earthquake modelling of centrifuge models. The energy for the dynamic actuation is stored in a flywheel, which has been previously energised using a motor. In the WES design, the drive utilises an air motor which will reduce the potential for electrical noise interference in the model instrumentation. A high speed clutch transfers the energy from the flywheel and associated oscillator to the base plate which supports the model in the Equivalent Shear Beam container. The interface between the ESB container and the actuator has been engineered to minimise the force requirement from the actuator by driving only the model and its (relatively) lightweight container. Lateral stiffness is provided by heavy steel slab sides around the ESB container which are not shaken directly by the oscillating base plate and form part of the counterweight or reaction mass for the model, thereby minimising the vibration that will be transmitted into the centrifuge platform. This design of actuator has benefitted from the high payload capacity of the WES centrifuge. The full performance of the actuator will be established during future commissioning at WES; it is anticipated that earthquake type shaking will be capable of being generated in excess of 150 gravities.

A dedicated data aquisition system has been developed to provide 32 additional channels of instrumentation at data capture rates suitable for earthquake and similar dynamic applications (at least 2500 samples per second on each of 32 channels). This logging system is designed to complement existing data aquisition systems developed under earlier research contracts for use on the WES centrifuge.

The final integration of the actuator and commissioning can only be achieved at WES because of the unique size and capabilities of the unit. However aspects of the system have been proven in collaboration with Cambridge University by centrifuge and lab

floor testing and this cooperative research effort has proved a substantial asset to the project, enabling WES to benefit from the sharing of costs in the development of a robust and cost-effective actuator unit.

Documentation detailing the design and manufacture of the actuator will be shipped with the unit itself and is not attached to this Report.

3.0 ACCEPTANCE

Delivery of the actuator and associated components to Mildenhall AFB will follow acceptance of the equipment kit and final crating.